CLAIMS

1. A pixel comprising:

a) a substrate having a photodiode, said photodiode having a light receiving area;

b) a color filter array (CFA) material of a first color disposed above said substrate, said pixel having a first relative responsivity; and

c) a light shield disposed above the substrate, said light shield forming an aperture, said aperture having an area substantially equal to the light receiving area adjusted by a reduction factor, said reduction factor being a result of an arithmetic operation between the first relative responsivity and a second relative responsivity associated with a second pixel of a second color.

2. The pixel of claim 1 wherein the reduction factor is the result of the first relative responsivity divided by the second relative responsivity.

3. The pixel of claim 1 wherein the light shield includes a metal layer.

4. The pixel of claim 1 wherein the light shield includes an opaque material.

5. The pixel of claim 4 wherein the opaque material is a dielectric material.

6. The pixel of claim 5 wherein the dielectric material includes a silicon dioxide.

7. The pixel of claim 1 wherein the pixel is a green pixel and the second pixel is a blue pixel.

8. The pixel of claim 1 wherein the pixel is a red pixel and the second pixel is a blue pixel.

9. A method comprising the steps of:

a) determining a relative responsivity (S_1) for a pixel of a first color;

b) determining a relative responsivity (S_2) for a pixel of a second color;

c) determining whether the relative responsivity (S_1) for the first pixel is more than the relative responsivity (S_2) of the second pixel;

if yes, forming a mask opening above the first pixel, said mask opening having an area substantially equal to the light receiving area adjusted by a reduction factor, said reduction factor being a result of an arithmetic operation between the relative responsivity of the first pixel

and the relative responsivity of the second pixel; and forming a mask opening above the second pixel, said mask opening having an area substantially equal to the light receiving area;

else,

forming a mask opening above the first pixel, said mask opening having an area substantially equal to the light receiving area; and

forming a mask opening above the second pixel, said mask opening having an area substantially equal to the light receiving area adjusted by a reduction factor, said reduction factor being a result of an arithmetic operation between the relative responsivity for a second pixel and the relative responsivity of the first pixel.

10. The method of claim 9 wherein the light receiving area is multiplied by the reduction factor.

11. The method of claim 9 wherein the arithmetic operation is a division operation.

12. A method to pattern an array comprising the steps of:

a) determining a relative responsivity (S_1) for pixels of a first color;

b) determining a relative responsivity (S_2) for pixels of a second color;

c) determining a relative responsivity (S_3) for pixels of a third color;

d) determining whether the relative responsivity (S_1) for pixels of the first color is lower than the relative responsivity (S_2) of pixels of the second color and the relative responsivity (S_3) of pixels of a third color;

e) if yes,

forming a mask opening above the pixels of the first color, said mask opening having an area substantially equal to the predetermined light receiving area;

forming a mask opening above the pixels of the second color, said mask opening having an area substantially equal to the predetermined light receiving area adjusted by a reduction factor, said reduction factor being a result of an arithmetic operation between S_1 and S_2; and

forming a mask opening above the pixels of a third color, said mask opening having an area substantially equal to the predetermined light receiving area adjusted by a reduction factor, said reduction factor being a result of an arithmetic operation between S_1 and S_3.

13. The method of claim 12 wherein the mask opening formed above the pixels of the second color has an area substantially equal to the predetermined light receiving area multiplied by (S_1/S_2); and the mask opening formed above the pixels of a third color has an area substantially equal to the predetermined light receiving area multiplied by (S_1/S_3).

14. The method of claim 12 further comprising the steps of:

a) determining whether the relative responsivity (S_2) for pixels of the second color is less than the relative responsivity (S_1) of pixels of a first color and the relative responsivity (S_3) of pixels of a third color;

b) if yes,

forming a mask opening above the pixels of the second color, said mask opening having an area substantially equal to the predetermined light receiving area;

forming a mask opening above the pixels of the first color, said mask opening having an area substantially equal to the predetermined light receiving area adjusted by a reduction factor, said reduction factor being a result of an arithmetic operation between S_2 and S_1; and

forming a mask opening above the pixels of a third color, said mask opening having an area substantially equal to the predetermined light receiving area adjusted by a reduction factor, said reduction factor being a result of an arithmetic operation between S_2 and S_3.

15. The method of claim 12 wherein the mask opening formed above the pixels of the second color has an area substantially equal to the predetermined light receiving area multiplied by (S_2/S_1); and the mask opening formed above the pixels of a third color has an area substantially equal to the predetermined light receiving area multiplied by (S_2/S_3).

16. The method of claim 12 further comprising the steps of:

a) determining whether the relative responsivity (S_3) for pixels of a third color less than the relative responsivity (S_1) for pixels of a first color and the relative responsivity (S_2) for pixels of a second color;

b) if yes,

forming a mask opening above the pixels of a third color, said mask opening having an area substantially equal to the predetermined light receiving area;

forming a mask opening above the pixels of a first color, said mask opening having an area substantially equal to the predetermined light receiving area adjusted by a reduction factor, said reduction factor being a result of an arithmetic operation between S_3 and S_1; and

forming a mask opening above the pixels of a second color, said mask opening having an area substantially equal to the predetermined light receiving area adjusted by a reduction factor, said reduction factor being a result of an arithmetic operation between S_3 and S_2.

17. The method of claim 12 wherein the mask opening formed above the pixels of the second color has an area substantially equal to the predetermined light receiving area multiplied by (S_3/S_1); and the mask opening formed above the pixels of a third color has an area substantially equal to the predetermined light receiving area multiplied by (S_3/S_2).

18. The method of claim 12 wherein the step of determining the relative responsivity (S_1) for pixels of a first color includes the steps of:

a) determining an input photodiode responsivity;

b) determining an input color filter array transmittance for the first color;

c) determining an input IR blocking filter characteristic;

d) computing a net response by multiplying the input photodiode responsivity, the input color filter array transmittance for the first color, and the input IR blocking filter characteristics;

e) determining an input light source spectral characteristic; and

f) convolving the net response and the light source spectral characteristics to generate the relative responsivity (S_1) for the first color.

19. The method of claim 12 wherein the step of determining the relative responsivity (S_2) for pixels of a second color includes the steps of:

a) determining an input photodiode responsivity;

b) determining an input color filter array transmittance for the second color;

c) determining an input IR blocking filter characteristic;

d) computing a net response by multiplying the input photodiode responsivity, the input color filter array transmittance for the second color, and the input IR blocking filter characteristics;

e) determining an input light source spectral characteristic; and

f) convolving the net response and the light source spectral characteristics to generate a relative responsivity (S_2) for the second color.

20. The method of claim 12 wherein the step of determining the relative responsivity (S_3) for pixels of a third color includes the steps of:

a) determining an input photodiode responsivity;

b) determining an input color filter array transmittance for the third color;

c) determining an input IR blocking filter characteristic;

d) computing a net response by multiplying the input photodiode responsivity, the input color filter array transmittance for the third color, and the input IR blocking filter characteristics;

e) determining an input light source spectral characteristic; and

f) convolving the net response and the light source spectral characteristics to generate a relative responsivity (S_3) for the third color.

21. The method of claim 12 wherein the first color is red, the second color is green and the third color is blue.

22. A method for manufacturing an improved pixel cell that employs a first metal layer as a light shield comprising the steps of:

a) forming a substrate having active devices, said active devices including a photodiode;

b) depositing a dielectric layer on the substrate;

c) performing via lithography and etch on the dielectric layer;

d) depositing a metal in the via;

e) polishing the metal;

f) depositing a metal layer on the dielectric layer; and

g) performing lithography and etch on the metal layer by employing a metal mask, said metal mask having a plurality of openings; wherein the mask opening above pixels of a first color having a lowest responsivity is equal to the area of the predetermined light receiving area; wherein the mask opening above pixels of a second color having a responsivity greater than the responsivity of pixels of the first color is equal to the predetermined light receiving area multiplied by S_1 divided by S_2 where S_1 is the relative responsivity of the first color and S_2 is the relative responsivity of the second color; and

wherein the mask openings above the pixels of a third color having a responsivity greater than the responsivity of pixels of the second color is equal to

the predetermined light receiving area multiplied by S_1 divided by $S_3$where S_3 is the relative responsivity of the third color.